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The Firm and its Governance over the Industry Life-Cycle

Jackie Krafft and Jacques-Laurent Ravix

Uniformity in modes of governance of the firm is now widely debated. So far, the predominant thesis was that there should be a superior model promoting optimality by disclosure of information and transparency. But today, this thesis is greatly contested, since the adoption of a unique and universal set of rules and arrangements neglects the diversity and heterogeneity of firms, industries, as well as institutional contexts (Becht, Jenkinson and Mayer, 2005). Moreover, evidence shows that this unique model of governance tends to generate major failures and turbulences, especially in innovative industries (Fransman, 2002; Lazonick and O'Sullivan, 2002; Krafft and Ravix, 2005). What emerges as a result is that different types of rules and norms should govern differently entrepreneurial as well as public firms, depending on the industry in which they operate and the stage of development of this industry.

The paper explores this issue by reconciling two trends of literature that are generally disconnected – the industry life cycle (ILC) on the one hand and the governance of large and small firms on the other – to generate results on how the governance of the firm may look like over the industry life cycle. When the two bodies of literature are connected, the immediate result is that the governance of small, young and innovative firms in the early stages of the life cycle should be different from the governance of large, mature and routinized firms.

Small young and innovative firms should benefit of a mode of governance based on *cooperation and assistance* to stimulate innovation, while large mature and routinized firms should be imposed a mode of governance based on *control* of the manager's action in the interests of shareholders. We argue that this immediate result can only be but preliminary, since age and size are not necessarily the key determinants of innovative behaviours of firms. In the ILC, small new firms engage product innovations, while large mature firms continue the process of innovation by investing in process capacities[1]. In that perspective, imposing these firms a governance based on *control* may not be the optimal solution, since we know that this mode of governance favours short term choices that may be detrimental to the development of innovation. What is more important is thus to consider how the innovative behaviour of firms can be maintained in phases of growth and decline of the industry. In the paper, we advance the idea that new principles of governance should be proposed for innovative corporations (large or small) as a distinctive category.

In a first step, we review the literature on the industry life cycle and on the governance of small and larger firms. We discuss the implications in terms of governance in the early stages of the life cycle and in the later stages. We argue that the vision of governance that results is too strongly based on the assumption that firms are highly innovative at the beginning of their life and much less as they age. This is not necessarily coherent with the ILC in which firms are innovative all along their life, and further questions the principle that some of them should be governed through a *cooperation and assistance* mode, while other ones should be governed by a *control* mode. In a second step, we advance that a more appropriate vision is to consider that firms, independently of their age and size, may be involved in radical innovation

[1] Economics of innovation also provides a clear assessment that innovation networks are composed of large and small firms in interaction (Antonelli, 2003; Saviotti, 1996). Theoretical considerations and empirical observations also suggest that, in many industries, large firms are still important drivers of innovation, either via the development of R&D capacities or via the provision of complementary assets (Teece, 1986; Chesbrough, 2003).

processes and, all along the development of such processes, have to face the competition of rival firms engaged in predator strategies. When innovation is put at the centre stage of the analysis, it is possible to show on the basis of an evolutionary game that, for a large range of parameters, the innovative strategy tends to be dominated over time by the predator strategy, if no external forces, such as corporate governance preserving long term innovation projects, do emerge. In a final step, we propose thus that the real determinant of assigning different modes of governance should be the presence of innovation, suggesting that *cooperation and assistance* has to be the key reference in that case, while the absence of innovation could alternatively legitimate *control* based on shareholder value maximisation as the leading principle. We derive new perspectives on the governance of innovative corporations, by defining the notion of 'corporate entrepreneurship' within which managers and investors are collectively involved in the coherence and development of small, but also large innovative firms.

2. Industry life cycle and the governance of firms

Since the original paper by Gort and Klepper (1982), it is now common knowledge among economists that key features of firms change as they age and progress over the life cycle. More recent contributions on the theme (Klepper, 1997) show that, in the early stages of the industry life cycle, many firms are product innovators, most of them are profitable and very few exit the industry. They operate on a small scale basis, each firm representing very small market shares. In the final stages of the cycle, on the contrary, firms tend to be big process innovators. They are very few in number and have large market shares. What is much less debated in the ILC literature is whether the governance of these firms changes over the ILC and how. Should firms be owned and managed the same way at the time they emerge, grow,

age, and decline? Or should there be distinct types of corporate governance along the phases of the ILC? On the one hand, the literature on start-ups and venture capital suggests that firms should be governed on the basis of a close cooperation between the founder entrepreneur (or professional manager) and the investor (business angel, venture capitalist). On the other hand, the literature on the governance of corporate firms generally supports the shareholder value vision in which the relationship between the manager and the investor are in terms of conflicting objectives, leading to a realignment of the manager's incentives in the investor's interests. The conclusion of these two trends of literature is thus that there should be distinct modes of governance over the ILC, one dedicated to small, young and risky firms, and based on *cooperation*; the other dedicated to older and mature firms, and based on *control*.

2.1. Key stylized facts of an ILC

The ILC literature proceeds from a basic biological analogy, positing that industries, like biological organisms, have different periods in their life (birth, growth, maturity, decline and death) and that their key characteristics change over time. In the following, we present major features of this body of literature, distinguishing what occurs in the early phases and late phases of the ILC (see also complementary information in the Annex attached to this paper)[2].

2.1.1. The early stages of ILC

The early stages of ILC are composed of phases 1 and 2, namely emergence and growth phases. Key stylised facts for innovation and organisation of industry are the following:

[2] Readers not familiar with this body of literature should eventually also refer to exhaustive surveys (Malerba and Orsenigo, 1996; Dosi and Malerba, 2002; Krafft, 2006).

Innovation: innovation is imported from technologically related industries, and diffused in the emerging industry by an exogenous information. Innovation generally concerns product definition and improvement, and generates an increase in product variety.

Organisation of industry : production increases, and since opportunities of profit are important, entry increases also. The volatility of market shares is very high.

2.1.2. The late stages of ILC

The late stages of ILC are composed of phases 3 to 5, namely maturity, decline and death phases. Key stylised facts for innovation and organisation of industry are the following:

Innovation: innovation is endogenously created by the experience of the incumbents, which may create barriers to entry for newcomers. Innovation concerns the process of production. Dominant designs tend to be adopted by end-users and standardization phenomena occur at the level of producers.

Organisation of industry : production falls, and a massive exit of firms occur (shakeout). Market shares tend to stabilize and first movers benefit of a competitive advantage.

2.2. Governance in the early stages of the ILC: cooperative governance of start-ups

The ILC gives the small new firms a key role in the impulsion of innovation. They are at the origins of a life cycle. This vision is corroborated by other approaches in industrial dynamics that focus on the asymmetric size distribution of firms, with a small number of large companies and a large number of small firms. This skewed firm size distribution has a remarkable persistence across industries, countries, and over time (Geroski, 1995). These numerous, small, new firms are moreover seen as crucial to economic development, especially because they are generally at the origins of new technological and market

opportunities whereas older incumbent firms are in a phase of decline of the life cycle (Audretsch, 1995).

In that perspective, the question of how these firms are financed during the seed phase is a key issue. Gompers and Lerner (2001) argue that a venture capital revolution has emerged for these firms. They sustain that (ibid, p. 145): "Venture capital is now an important intermediary in financial markets, by providing capital to firms that might otherwise have difficulty attracting financing. These firms are typically small and young, plagued with high levels of uncertainty and large differences between what entrepreneurs and investors know".

In the literature, this issue on the respective knowledge of the manager and the investor has been treated for a long time in agency terms, i.e. in a framework based on asymmetric information and complete contracts. The manager has important incentives to engage unproductive expenditures, since he does not bear the entire cost of it; or to develop an insufficient level of effort, since this level is not directly observable by the investor. These important information asymmetries between the entrepreneur and the venture capitalist can be solved on the basis of a complete or quasi complete contract (Jensen and Meckling, 1976; Grossman and Hart, 1986; Hart and Moore, 1988). The solution broadly lies in the investor's scrutinization of firms before providing capital and monitoring them afterwards, especially by participating to the board of directors and defining compensation schemes (including stock options). The outcome is, very often, highly complex venture capital contracts (Gompers, 1995, 1996; Kaplan and Stroemberg, 2003, 2004) that limit their applicability in the real world. In addition to the argument on the lack of simplicity, Aghion and Bolton (1992) show that inefficiency does not only affect managers, and that unsolvable agency problems

(involving the manager and the investor) may arise. Because of uncertainty, situations arise that can not be foreseen or planned for in an initial contract.

New developments thus tend to recognize that the relation between the investor and the manager is necessarily based on incomplete contracts (Audretsch and Lehman, 2006). In that case, what entrepreneurs and investors know is highly dependent on their specific skills, experiences, and practices. Since this knowledge is not easily transferable, the investor and the manager have to develop close connections in order to progressively share their respective knowledge. Close connection is especially necessary, since lenders have to face with evaluating innovative but less proven business concepts. Small new firms do not generally demonstrate established history of earning and financial stability. Also, for many start-ups, the primary assets are intangible and difficult to value, thus failing to satisfy requirements for asset-based security. In that case, venture capitalists and business angels finance new and rapidly growing companies, and especially purchase equity securities. But, to do this, they generally assist the development of new products or services, and add value to the company through active participation. They usually take higher risks with the expectation of higher rewards, and have a long-term orientation.

The nature of the relationship between the manager and the investor is thus based on *cooperation and assistance*: the founder-entrepreneur or the professional manager has to diffuse his own knowledge on the characteristics of his innovation and market potentialities, while the business angel or venture capitalist has to propose different solutions to finance the initial step of elaboration of the innovative project, as well as its development over time.

2.3. Governance in the late stages of the ILC: control-based governance of mature firms

The ILC views large firms as key actors in the development of innovation, especially by their greater capacity to invest in process innovation, based on the accumulation of knowledge and competences since their entry at the beginning of the life cycle. However this phenomenon can also be analysed in reference with the pervasive effects it may generate, such as the erection of barriers to entry that deter innovative entry, the dominance of suboptimal dominant designs and standards, and eventually the engagement into inefficient choices from the manager in a situation where large size increases bureaucracy and decreases the intensity of competition. These pervasive effects, and especially the third one, are at the core of the literature on the governance of large, mature firms.

In the big corporation, the governance problem is essentially to persuade the manager to behave fairly on behalf of the investor, and to avoid any discretionary behavior. The general solution to this agency problem is to grant managers a highly contingent, long term incentive contract *ex ante* to align his interests with those of principals (Schleifer and Vishny, 1997). The formalization, strongly based on a complete contract hypothesis, provides the essential requirements of corporate governance oriented towards shareholder value within a context of transparency of information and generalization of contractual relations in organizations. Managerial corrections may take various forms (board of directors, proxy fights, hostile takeovers, corporate financial structure), and are always oriented towards monitoring and disciplining management in the interest of shareholders and investors.

Complementary approaches are also developed on the basis of transaction costs (Williamson, 1985), and property rights (Hart, 1995a) in order to consider weaker rationality hypotheses,

and higher costs of negotiating and writing down contracts. This literature more deeply relies on notions of incomplete contracts and residual rights of control[3] that are absent of agency theory. But, despite these differences, transaction costs and property rights literature generally come up to the same conclusions as agency theory concerning the rules of governance of large publicly held companies (Hart, 1995b; Williamson, 1988 and 2000).

The nature of the relationship between the manager and the investor is based on *control*: the investor orientates and monitors the choices of the manager. The investor, from the information of key indicators such as Return on Investment, or Economic Value Added/ Market Value Added, has the capacity to evaluate whether the manager has behaved fairly to shareholders or not. From these indicators, the investor checks whether the manager has transformed his background knowledge into shareholder value maximizing strategies.

2.4. Summing up

When we relate the literature on the ILC with the one on the governance of firms, we end up with two sets of results: one related to the governance of firms in the early stages, where *cooperation and assistance* modes of governance should dominate, and one related to the governance in the late stages that should be based on *control* and realignment of incentives. In small new firms that operate in the early stages of the life cycle, the manager is the innovator, the founder entrepreneur or a professional manager, whose role is to discover new technological and market opportunities. The investor is often a business angel or a venture capitalist that assists the development of new products, adds value to the company, takes higher risks with the expectation of higher rewards, and has a long-term orientation. The

[3] The asset owner has the residual right to decide how to use the asset in cases where the contract is silent on the occurrence of some event affecting this use.

governance is thus based on *cooperation and assistance*, and is supported by different structures, such as the development of scientific and R&D committees, to increase the long term performance of the firm. Alternatively, large and mature firms that dominate the late stages of development of the industry are governed by a board of directors that run the company in the interests of the shareholders. Very often these shareholders are institutional investors, such as pension funds, that tend to realign the managers' incentives, fight against manager's discretion, and assess the value of the company on purely financial criteria. They are short-term and risk minimization oriented (Table 1).

	Early stages: emergence and growth of the industry	**Late stages: maturity and decline of the industry**
Type of firm	Small, new firms	Large, mature firms
Type of manager	Innovator, Founder Entrepreneur, professional manager	Board of directors
Role of manager	Discover new technological and market opportunities	Run the company in the interest of the shareholders
Type of investor	Business angel, venture capitalist	Institutional investors (pension funds)
Role of investor	Assist the development of new products or services Add value to the company through active participation Take higher risks with the expectation of higher rewards Have a long-term orientation	Realign the manager's incentives Fight against manager's discretion Assess the value of the company on the basis financial criteria Minimize risks Have a short-term orientation
Nature of governance	Cooperation and assistance	Control
Structure of governance	Scientific committees Research and development committees	Audit committees, Compensation systems, proxy fights, hostile takeovers

Table 1: Governance in the early and late stages of the life cycle

The issue now is whether we can consider this dichotomy as robust to the main changes that occur all along the ILC, and especially to the development of innovation. Firstly, we can note that this dichotomy is mainly driven by a specific vision of firms, being very innovative at the beginning of their life and much less as they age. This vision can be discussed, especially since the ILC does not necessarily ends up with these drastic conclusions. Firms, as they age, tend to reduce their spectrum of product innovation, but are the sole firms to possibly invest in process innovation. Moreover, first movers that become the leaders of the industry build their competitive advantage step by step, since what they do in each period of the life cycle has direct implications on subsequent periods. Finally, barriers to entry are related to the exploitation of knowledge and experience accumulated over time by firms, and not necessarily to the willingness of incumbents to deter entry. Secondly, we can also note that the reflection on the governance of small firms has greatly changed over time, starting from basic *control* modes of governance inspired by agency theory, and ending up with more operational and pragmatic modes of governance based on *cooperation and assistance*. On this point, the recognition that knowledge of the manager was necessarily different from – yet highly complementary to – the knowledge of the investor, has been determinant in the change of vision. We think that a similar argument should be investigated also at the level of the large innovative firm.

3. Innovative behaviours and predator constraints

In what follows, we consider that innovation, which is at the centre stage of the ILC literature, should be a major criterion for defining the appropriate modes of governance over time. In fact, because innovation can either be long term or short term oriented, different modes of governance might be required for firms engaging these innovative strategies. We develop an

evolutionary model to show that long term innovation has to be preserved because, in a competitive context where predator firms exist, long term innovation cannot be but a dominated strategy.

3.1. Basic Assumptions

Let us imagine a network of firms, i.e. composed of large and small firms of different age, that decide to join their efforts to develop a major, long term innovation. This network of long term innovators is competing with a group of predator firms willing to develop in the same business activity an incremental innovation, less sophisticated and more rapidly available. We assume, as a general principle, that the engagement of investments from firms within the innovation network increases the profitability of long term innovation, while the engagement of investments from predator firms outside the network decreases the profitability of this long term innovation. Consequently, a "critical mass" of firms in the network has to be reached for long term innovation to be profitable in the long run.

3.2. The model

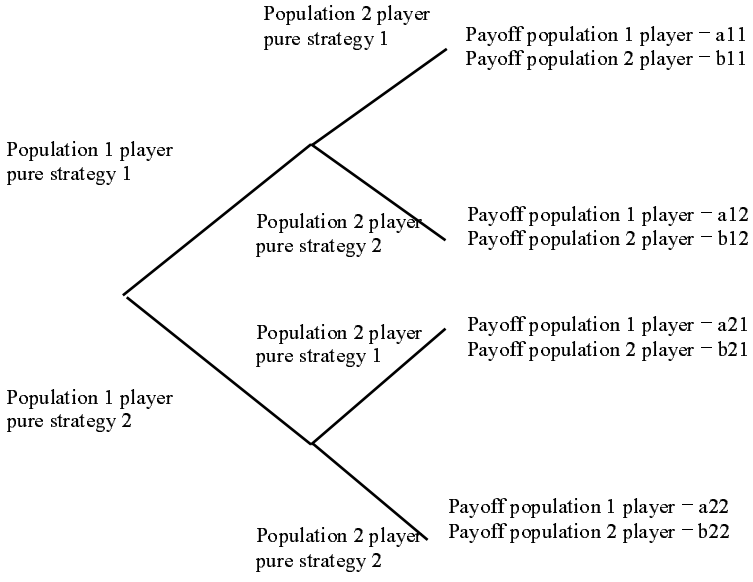
This situation can be formalized on the basis of a two-dimensional linear evolutionary game in which firms come from two strategically distinct populations[4]. Population 1 is composed of network firms, engaged in a long term innovation, and characterized by a payoff matrix A. Population 2 is composed of predator firms outside the network, and characterized by a payoff matrix B. Each population has two alternative actions: to invest (pure strategy 1) or not to invest (pure strategy 2).

[4] This model is derived from Foss (1994), and Krafft and Ravix (2005). In the published version, our results are derived using numerical example. In the present version, more general results are obtained, using range of parameters.

The game is specified by the payoff matrices $A=(a_{hk})$ and $B=(b_{hk})$, where $a_{hk} \in R$ (payoff to population 1 player) and $b_{hk} \in R$ (payoff to population 2 player) when population 1 player uses pure strategy h and population 2 player uses pure strategy k.

$$A = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} \qquad B = \begin{vmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{vmatrix}$$

The "critical mass" principle according to which the greater the number of firms in the innovation network willing to invest, the more profitable long term innovation will be (alternatively the greater the number of firms investing in the predator strategy, the lower will be the profitability of long term innovation) can be expressed by the following decision tree and gives the corresponding ranking of returns (Figure 1).



The payoffs ranking is the following:
$a_{12}>a_{22}>a_{21}>a_{11}$
$b_{21}>b_{11}>b_{22}>b_{12}$

Figure 1: Decision tree and payoffs ranking

Populations 1 and 2 are considered as large populations of firms. Initially, each population is divided into the fraction $x_1 \in [0,1]$ (respectively $y_1 \in [0,1]$) of players in the population

currently choosing pure strategy 1, and the fraction $x_2 = 1-x_1$ ($x_2 \in [0,1]$) (resp. $y_2 = 1-y_1$, $y_1 \in [0,1]$) of the population choosing pure strategy 2. As the population state (x_1,x_2) (resp. y_1,y_2) changes, so do the payoffs to the pure strategies. Changes in the population states are governed by the replicator dynamics. Firms are randomly drawn two by two from these populations to play the game (one firm from each player population). If the payoff to a player in the first (resp. the second) population depends only on the distribution of actions $(y_1,1-y_1)$ in the other population (resp. $x_1,1-x_1$), the replicator dynamics can be expressed as follows, by a system of time derivatives of the population state $(x°_1, y°_1)$ which depends on the payoffs difference between the first and second pure strategies:

$$x°_1 = [(a_{11}-a_{21})y_1-(a_{22}-a_{12})y_2]x_1x_2$$

$$= [(a_{11}-a_{21})y_1-(a_{22}-a_{12})(1-y_1)](1-x_1)x_1$$

$$y°_1 = [(b_{11}-b_{12})x_1-(b_{22}-b_{21})x_2]y_1y_2$$

$$= [(b_{11}-b_{12})x_1-(b_{22}-b_{21})(1-x_1)](1-y_1)y_1$$

3.3. Results

For a large range of parameters, $y°_1$ is always increasing, while $x°_1$ increases when $y_1 < y_1^*$, and decreases when $y_1 > y_1^*$, with $y_1^* = (a_{11}-a_{22}) / (a_{11}-a_{12}+a_{22}-a_{21})$. In this case, the first action (first column) is dominant for population 2 players and the second action (bottom row) is the best reply by population 1 players. This is characteristic of an iterated dominated strategies game (see Friedman, 1996; Weibull, 1995), where the corner $(x_1,y_1) = (0,1)$ is the unique Nash Equilibrium. This Nash Equilibrium is automatically an Evolutionary Stable Equilibrium because it is a solution by iterated elimination of dominated strategies (Figure 2).

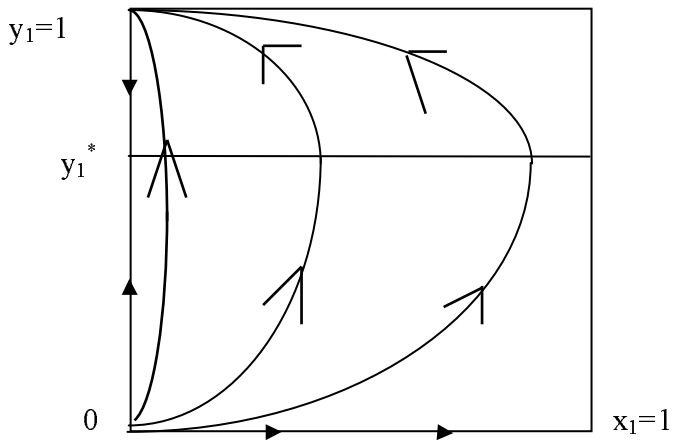


Figure 2: Evolution of Populations 1 (innovators, x-axis) and 2 (predators, y-axis)

This figure shows that the proportion of population 2 players (predator firms) deciding to engage investments (noted y_1) increases monotonically along a large range of solution orbits. The proportion of population 1 players (innovation network firms) deciding to engage investments (noted x_1) increases until y_1^* and decreases thereafter.

3.4. Comments

Three sets of comments can be derived from the model.

1) The long term innovative strategy after being attractive to a growing part of the population of network firms becomes less and less adopted. The population of firms willing to undertake such a behavior decreases to finally equal zero. By contrast, the rival predator strategy becomes more and more prevalent and, in the end, the entire population of firms is effectively engaged in this strategy.

2) The lower the value of y_1^*, the higher the rapidity of extinction of pure strategy 1 in population 1, i.e. the innovative behavior in the network. Alternatively, the higher the value of y_1^*, the longer population 1 firms will maintain the innovative behavior. At the end of the game, predator firms are dominant, but this may result either of a long or rapid process of competition between predator and long term innovative firms.

3) The model suggests that external forces have a crucial role to play in sustaining or not innovative strategies. If we try to relate the heuristics of this model to what occurs in the concrete world, we consider that principles of governance that could encourage firms to sustain long term innovative strategies, up to the point $(x_1,y_1)=(1,1)$, where innovation is maintained despite predator strategies, are a major form of this kind of external forces.

4. The governance of innovative firms

From the conclusions of the model above, we derive that the industry faces two different kinds of evolution. Natural market forces, operating without any external intervention, lead predator firms to dominate the industry all along the ILC, and especially in the later stages. If, on the contrary, investors may want to invest in long term innovation strategies, then innovative firms have the possibility to survive in the long run. In that case, intervention in favor of innovation must be operated beyond the early stages, in order to go against the natural trend of the ILC and, further, ensure the survival of innovative firms in later stages.

This strategy implies to encourage cooperation between managers and investors that can give support to the development of common learning processes. In formal models, this implies to extend the formalization to non-purely adaptive behaviors of firms, i.e. to move from

replicator dynamics to learning evolutionary games (Kandori, Mailath and Rob, 1993; Samuelson, 1997)[5]. In practical terms, for corporate governance, learning processes mean that both managers and investors are jointly committed to develop an entrepreneurial behavior favoring long term perspective, knowledge creation and coordination for innovation, and implying the acceptance of a greater confrontation to uncertainty and a higher risk taking. In that perspective, corporate governance is dedicated to the coordination of learning processes, meaning that corporate governance and the governance of knowledge are two facets of the development and coherence of the firm (Penrose, 1959).

This mode of corporate governance has been already analyzed by referring to the notion of "corporate entrepreneurship" (Krafft and Ravix, 2006, see also Foss and Christensen, 2001, and Klein and Klein, 2002, for related approaches). Corporate entrepreneurship is a hybrid form mixing the *cooperation* and *control* modes described earlier in Section 2. Managers, by defining and selecting innovative processes, and investors, by determining the money that is invested to sustain these processes, both take part to the creation and governance of new knowledge by the firm. *Cooperation* must exist between managers and investors, since they collectively contribute to corporate development and coherence. Only in a second step does *control* occur: the investor reacts to the innovative choice, by comforting or refuting the innovative conjecture.

[5] These formal developments are beyond the scope of the current paper.

4.1. Governance based on corporate entrepreneurship: cooperation for the creation and coordination of new knowledge

Long term innovation affects corporate coherence, since it involves important reconfigurations of resources and competencies over time. (Chatterjee and Wernerfelt, 1991; Foss, 1993; Teece and Pisano, 1994; Teece, Pisano and Shuen, 1997; Piscitello, 2004). In order to preserve corporate coherence in an innovation context, two sets of problems have to be solved (Foss and Christensen, 2001). First, the problem of knowledge creation, i.e. how knowledge arises from new combinations, and from the discovery of new complementarities between existing stocks of knowledge and experimentation of new learning processes. Second, the problem of coordination of knowledge dispersal, that goes together with the specialization of tasks in large corporations, and involves efforts in constructing shared cognitive patterns.

The role of the manager is crucial in solving these two sets of problems. First because managerial control has a basic facet of stimulating the entrepreneurial activity of the different stakeholders within the firm, but also among the network of innovation partners, that favours knowledge creation. Second because managerial control also involves command, management information systems, corporate routines and corporate cultures, that can act as knowledge coordination. In order to maintain corporate coherence, the manager has a key role to play in the achievement of a critical mass of stakeholders (at the level of the firm and also at the level of the network) playing the long term innovative strategy, while refraining the temptation of predator behaviours in the meantime.

The investor also is highly involved in the process. Investors have to develop new competences and experience in the evaluation of long-term innovative companies, since usual

market criteria essentially refer to tangible assets and require long term track records that are often neither applicable nor available in highly innovative contexts. In that perspective, the valuation of intangibles by investors becomes a real issue: valuation is the outcome of a process of coordination of different elements of knowledge related to the perceived ability of the firm to create new technological and market opportunities; valuation is also a key element in sustaining some innovative projects (and not others) that shape the evolution of the industry.

Corporate entrepreneurship means that managers and investors are mostly intertwined *ex ante* in the process of solving corporate coherence problems in the modern cognitive firm. Each actor is endowed with a different piece of knowledge that has to be recombined in a process of collective learning oriented towards corporate development. The manager brings his own competences on the development of learning processes by creating diversity, exploring new opportunities, and providing continuity in innovation. The investor also contributes to the development of learning processes by providing the manager his own skills and experiences on the financial feasibility of external restructurings (M&As, cooperations), or internal strategies (compensation plans, reporting activities, information systems). Cooperation between managers and investors favours the processes of creation and coordination of new knowledge that are engaged in a long-term innovative context. But the investor also has to control *ex post* the impact of innovative choices implemented in the company.

4.2. Governance based on corporate entrepreneurship: control to comfort or refute the innovative conjecture

If initially long term innovation greatly disturbs corporate coherence, one should expect over time that corporate coherence is improved. Here thus, *control* must be operated to guarantee that coherence is restored or at least evolves towards a reasonable level.

The manager has to provide the investor with regular information (documents, reports, etc.) explaining whether the innovative strategy impacts corporate coherence and how. If after a sufficiently long time span, the innovative strategy generates new knowledge but insufficiently coordinated, or if the critical mass of efforts is not obtained and that stakeholders massively turn to adopt the predator strategy, then the manager and the investor can jointly infer that erroneous decisions were implemented during the innovation process. The investor checks *ex post* that the manager implements the productive and organizational decisions (cooperation agreements or M&As within the innovation network) dedicated to sustain the critical mass of efforts, and further the long term innovative strategy. Contrary to shareholder value maximization principles, the problem of the investor is not to limit the discretionary power of the manager but, rather, to control this power. Especially, the investor has to control the manager's trustworthiness, and eventually his propensity to "empire building", in reference to his ability or inability to restore corporate coherence after the engagement of a long term innovative strategy. When innovation is concerned, thus, the issue is not to impose drastic changes in strategies based on the belief that what the investor (respectively the manager) knows is always right. Rather, the issue is to control that innovation is developed and that corporate coherence is progressively restored.

4.3. Summing up

Corporate governance is thus constructed step by step with an *ex ante* process of collective learning, and an *ex post* process of control, in which each actor embodies a piece of diversified and specialized knowledge related to their respective domains and fields of experience, that has to be recombined and used to stimulate corporate development.

Table 2 provides more details on the governance of innovative firms based on corporate entrepreneurship.

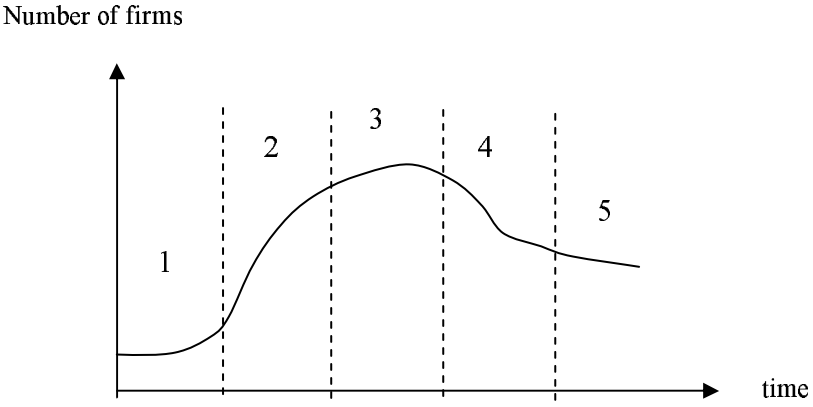
	The governance of innovative firms
Type of firm	Innovative firms, independently of their age and size
Type of manager	Mix of the Professional Manager and the Entrepreneur
Role of manager	Discover new technological and market opportunities Run the company in the interest of all stakeholders
Type of investor	Long term investors
Role of investor	Add value to the company through active participation Assess the value of the company on the basis of economic and financial criteria Have a long-term orientation, even if risky
Nature of governance	Corporate entrepreneurship: Cooperation, assistance, and control
Structure of governance	Different types of committees: Scientific, R&D and end-users, audit, compensation systems

Table 2: The governance of innovative firms

Principle of governance concern here innovative firms, independently of their age and size. The manager has the double role to act as a professional manager and as an entrepreneur, which means that he has to run the company in the interests of all the stakeholders that contribute to the value of the firm, and also to discover new technological and market opportunities by the active involvement of all stakeholders in learning processes. The investor has to develop a long term orientation, and is deemed to assess the value of the company on the basis of economic and financial criteria. *Cooperation and assistance* between the manager and the investor must dominate, on the basis of specific structures of governance favouring common learning processes. One could for instance think about scientific, R&D or end-users committees as structures of governance of this kind. In the meantime, *control* also has to occur on the basis of more traditional structures of governance, such as audit and compensation systems.

ANNEX: Stylized facts of an ILC (elaborated on the basis of Gort and Klepper, 1982; and Klepper, 1997)

The five stages of development of an industry



The five stages of evolution are determined by the following process :

$F_t = P_t (N-n_{t-1})$

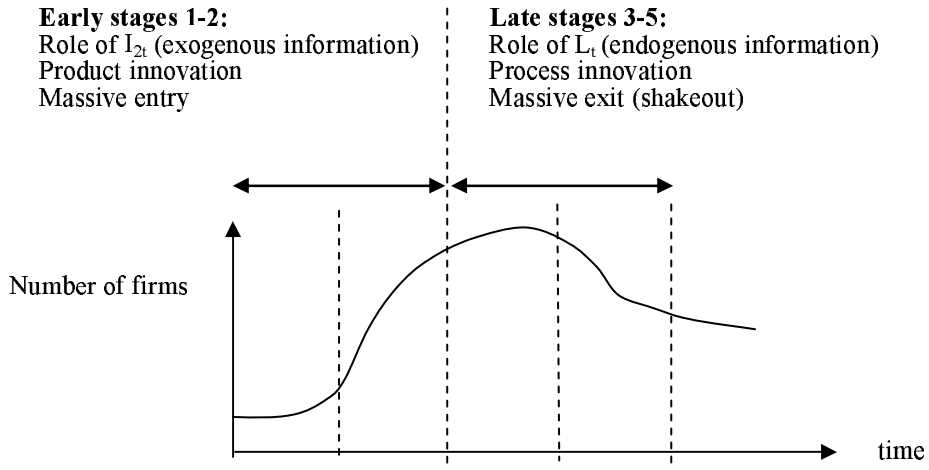
where F_t, the number of new entrants in time t ;

P_t, the probability of entry in t of each potential entrant ;

N, the population of potential entrants ;

n_{t-1}, the number of firms that already entered the market in t-1.

Information, Nature of innovation and processes of entry/exit



The probability of entry P_t is :

$P_t = f(I_{2t}, L_t, \Pi_t)$

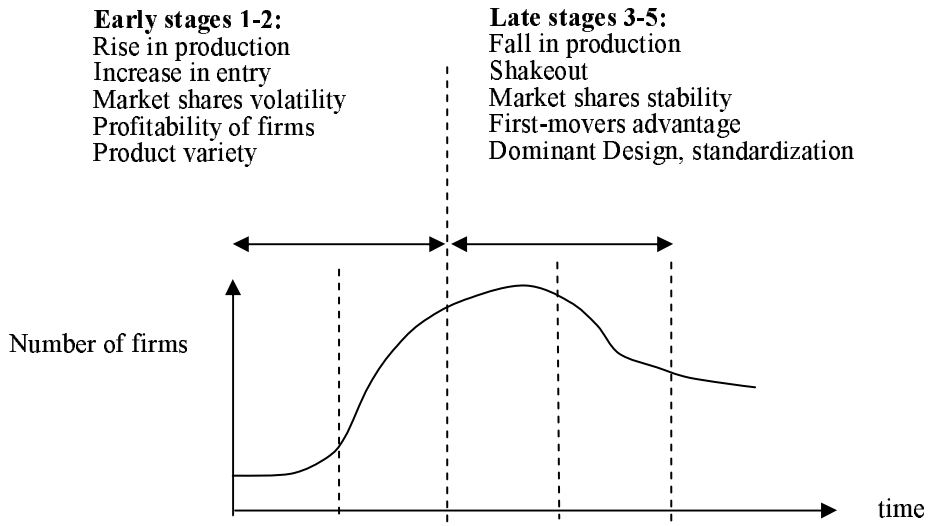
where I_{2t}, the number of innovations at time t coming in the industry exogenously ;

L_t, the stock of experience of incumbent firms ;

Π_t, the profit of incumbents at time t ;

And such as : $\delta f/\delta I_{2t} > 0$, $\delta f/\delta L_t < 0$ et $\delta f/\delta \Pi_t > 0$

Regularities in the development of industries



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